

Analysis of Expected Rating Changes – June 2010 Portfolio Manager Release

This report is for internal use by EPA only – Do not distribute externally

This report summarizes expected rating changes due to the application of new models starting on June 7, 2010. A large percent of Portfolio Manager users will be affected by the following four changes:

- I. New Data Center performance rating scale
- II. New calculations on Square Feet and Personal Computer Density for Office model
- III. New calculations on Register Density for Retail model
- IV. Updates to Parking Space adjustment

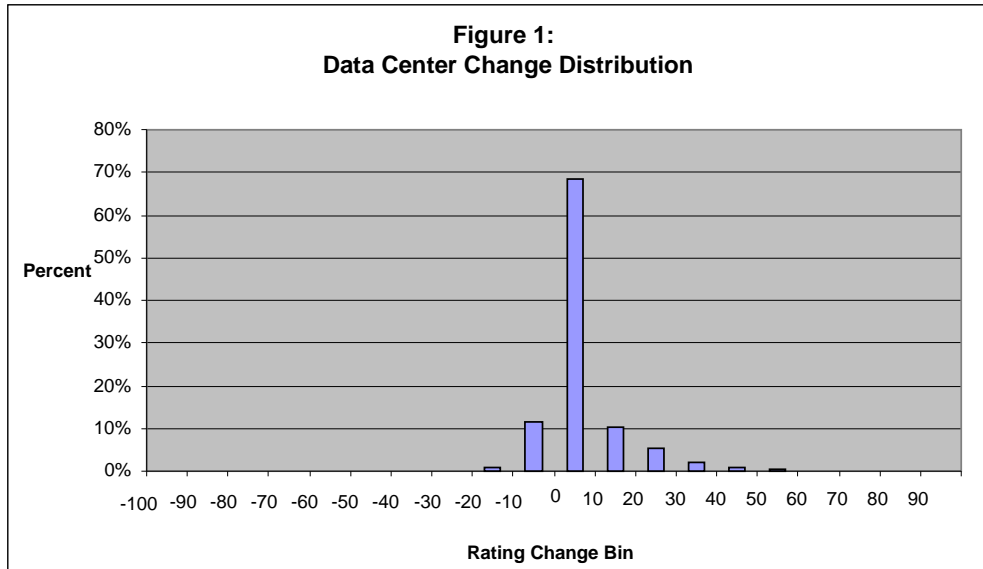
This document presents the details of each change, including its anticipated affect on scores. These results are based on an analysis of Portfolio Manager data pulled in the course of development, on January 24, 2010. As building data may have changed over the ensuing months, exact changes may differ from these projections.

I. Data Center Changes

Data Center Rating Changes

The initial report provided by SRA included 13,869 buildings with Data Centers. A basic set of filters was established by EPA to remove extreme/questionable data from the analysis. A complete list of filters is provided in **Attachment A**. After the filters, a total of 11,316 buildings were analyzed.

- The average change across all 11,316 data center buildings is +5 points
 - 17% experience a decrease, with an average of -4 points
 - 67% experience an increase, with an average of +9 points
 - 16% experience no change
- **Figure 1** presents the distribution of rating changes for Data Centers. The distribution is close to normally distributed about zero with a positive skew, indicating that the majority of buildings experienced a rating increase. The majority of changes are within +/-10 points.
 - Over 56% of the buildings change within +/- 3 points
 - Over 80% of the buildings change within +/- 10 points
- The 11,316 buildings with Data Centers represent different types of buildings. **Table 1** below shows the breakdown of building types with data centers and the average rating change for each building type.
- The current model does not allow buildings with Data Centers that are larger than 10% of the total floor space to receive ratings. These buildings will be eligible to receive a rating after the new model is released on June 7, 2010. **Table 2** shows a count of these buildings by Building Type.



Building Type	Count	Average Rating Change
Office	7452	7
K-12 School	2597	2
Hospital (Acute Care or Children's)	594	2
Bank/Financial Institution	260	7
Hotel	157	0
Courthouse	84	2
Medical Office	84	6
Warehouse (Unrefrigerated)	54	7
Supermarket/Grocery	12	NA
Other	6	NA
Retail	6	NA
Residence Hall/Dormitory	4	NA
House of Worship	3	NA
Warehouse (Refrigerated)	2	NA
Distribution/Shipping Center	1	NA

Averages not shown for types with fewer than 50 buildings

Table 2 Data Centers That Are Larger than 10% of Floor Space

Breakdown by Building Type	
Building Type	Count
Office	210
Other	127
Warehouse (Unrefrigerated)	3
Medical Office	3
Bank/Financial Institution	2
Hospital (Acute Care or Children's)	1

Data Center Label Eligibility

At the time when the data was pulled (January 24, 2010), 2,211 of the buildings with Data Centers in the analysis had earned the label.

- Recent winners – Out of the 1,791 that have earned a label in 2008 or 2009:
 - 1,686 buildings have ratings of 75 or higher prior to the change
 - 1,609 will continue to have ratings of 75 or higher after the release
 - 77 will have ratings that drop below 75 *these buildings will lose their current label eligibility*
 - 105 buildings actually have ratings below 75 prior to the change
 - 58 will see an increase with the release, bringing the rating to 75 or higher
 - 47 will continue to have ratings below 75 after the release

Data Center Technical Details

A new Data Center model has been developed. Basic characteristics of the new rating model are as follows:

- **Data:** The new model is based on a data collection effort led by EPA in consultation with stakeholders and industry leaders.
- **Dependent Unit of Analysis:** The new model is based on Power Usage Effectiveness, or PUE. This variable is unique to the Data Center space type. Source energy use intensity (source EUI) is used for the majority of EPA's rating models, but was not considered to be the best choice for a Data Center model. Source EUI can vary widely for data center facilities, and does not take into consideration the varying densities of IT equipment that can be present in these facilities. PUE is a standard measure of facility infrastructure efficiency in the IT industry. It is equal to the total energy consumption of a Data Center (for all fuels) divided by the energy consumption used for the IT equipment. This is a measure of how much energy is consumed by the power supply and cooling systems in a Data Center relative to the amount of energy delivered directly to the IT equipment.
- **Independent Variable** – There is one independent variable in the Data Center model (refer to following section for complete input requirements). This variable is the IT Energy, or the energy used to power the IT equipment. This is a unique attribute for Portfolio Manager .because the IT Energy is actually read from an energy meter that is a sub-meter within the building.

Prior to June 7, only buildings with Data Centers that are 10% or less of the floor area have ratings in Portfolio Manager. After June 7, these will still be the only Data Center buildings to see ratings. This is because no buildings will have information for the new IT Energy meter,

which is required for an accurate rating. ***In recognition of this new requirement, EPA will provide estimated values for Data Center energy consumption to ensure that buildings that have ratings now still have ratings after the change.*** The estimated values used for this calculation will only be available in Portfolio Manager until June 2012, after which time IT Energy meters will be required. The average rating change for the buildings that will be given estimates is approximately +7 points.

Buildings with Data Centers that are larger than 10% of the floor area do not currently have ratings, will not be given estimated values, and therefore will not have ratings on June 7. They will be able to get ratings only once they enter IT Energy data.

In general, buildings that currently have ratings and have data centers should expect an increase in rating because the new estimates are more appropriate for the current state of the IT industry. The old estimates were implemented in 2004 and were conservative adjustments. The new estimates are based on the more recent data collection, which provides a greater allowance for the energy intensity of Data Centers.

In addition to this overall positive trend, the following behavior is noted:

- **Percentage of the building that is Data Center:** Buildings with a larger percentage of Data Center space will see larger increases in ratings.
 - The majority of Data Centers, approximately 85%, have less than 5% of their floor area classified as Data Center and have an average rating change of +6 points
 - Buildings with Data Centers that are between 5 and 10% of the floor area represent about 15% of the sample.
 - These buildings are likely to see larger increases of approximately +20
 - These buildings also tend to have *office* computer density and worker density that is 25-30% larger than the office spaces in buildings with smaller data centers. This suggests that these buildings may be entering too many computers in their office space. They may be entering computers in their office space as a means of overcompensating for the perceived needs of their data center. ***Computers and equipment in a data center should not be counted in an office, as this is double counting.*** It is quite possible that some of these facilities are incorrectly using Data Center space and/or adding extra workers and computers within their office.

Data Center User Inputs

The official definition of Data Center has been modified to ensure that it is clear when this space type should be used:

Data Center applies to spaces specifically designed and equipped to meet the needs of high density computing equipment such as server racks, used for data storage and processing. Typically these facilities require dedicated uninterruptible power supplies and cooling systems. Data Center functions may include traditional enterprise services,

on-demand enterprise services, high performance computing, internet facilities, and/or hosting facilities. Often Data Centers are free standing, mission critical computing centers. When a data center is located within a larger building, it will usually have its own power and cooling systems. The Data Center space is intended for sophisticated computing and server functions; it should not be used to represent a server closet or computer training area.

It is highly likely that there are many Data Centers in Portfolio Manager that have not been correctly classified (e.g. small server rooms or computer training areas). These spaces will have to be re-classified (deleted and the square foot combined with the larger primary space such as Office). An FAQ has been developed to guide users through this process. If a Data Center space is misclassified it is likely to see a rating increase on June 7th, when the changes go live. However, the rating will decrease after the space is re-classified. The net change (after they reclassify) will be approximately -3 points. Effectively these spaces are using Data Center incorrectly (under the old or new system), resulting in unduly high ratings. Thus, when they are properly classified along with the main primary space, a slight rating decrease is expected.

There are three required inputs and two optional inputs for Data Center.

1. Gross Floor Area (required)
 - a. The total gross floor area is measured between the principal exterior surfaces of the enclosing fixed walls and includes all supporting functions for the Data Center. This should include the entire Data Center for stand alone facilities, which may have raised floor computing space, server rack aisles, storage silos, control console areas, battery rooms, mechanical rooms for cooling equipment, administrative office areas, elevator shafts, stairways, break rooms and restrooms. When a Data Center is located within a larger building, the total gross floor area should include the computing space as well as any mechanical rooms or office spaces that support the Data Center.
 - b. The Gross Floor Area will be a field which can be entered in ft² or m² as for other space types.
2. IT Energy Configuration (required)
 - a. The IT Energy Configuration designates the location where the IT Energy consumption will be measured. The preferred location of this measurement is at the output of the Uninterruptible Power Supply (UPS) meter. Please refer to the definition of IT Energy for other meter locations which are permitted under certain conditions when UPS readings are not available.
 - b. The IT Energy Configuration will be selected from a drop-down menu. There are 6 options:
 - i. Uninterruptible Power Supply (UPS) supports only IT Equipment.
(preferred)
 - ii. UPS includes non-IT load of 10% or less.
 - iii. UPS includes non-IT load greater than 10%. Non-IT load is sub-metered.
 - iv. UPS includes non-IT load greater than 10%. Non-IT load is not sub-metered.
 - v. Facility has no UPS.
 - vi. IT Energy is not currently metered at this facility – Apply estimates.

1. *Note that Estimates will only be permitted until June 2012, and only for Data Centers that are less than 10% of the building floor area.*
3. IT Energy Meter (required)
 - a. The IT Energy is defined as the total amount of energy required by the server racks, storage silos, and other IT equipment in the Data Center. For the purposes of ENERGY STAR this should be measured at the output of the Uninterruptible Power Supply (UPS). A measurement of IT Energy from the UPS output is consistent with a Level I measurement of data center Power Usage Effectiveness, or PUE.
 - i. These measurements should be taken as energy readings, in kWh. They should not be instantaneous power readings. Input fields permit readings for a user-determined measurement time period (e.g. weekly, monthly, or quarterly). Monthly measurements are recommended, roughly on schedule with utility readings, if possible.
 - ii. Facilities that do not have a UPS are permitted to supply readings from a Power Distribution Unit (PDU) or alternate location. In these cases, readings should be made from the input of the PDU, or the first available measurement point. For consistency, if the measurements are available at the PDU input, they should be reported in favor of rack-level or other measurements.
 - iii. Facilities for which more than 10% of the UPS load is directed to non-IT (e.g. mechanical) equipment are required to provide a reading that excludes the non-IT equipment. Two options are permitted:
 1. If energy used by non-IT equipment is measured, then it may be subtracted from the total UPS energy, and the remainder should be entered into the UPS Output Meter in Portfolio Manager
 2. If energy used by non-IT equipment is not measured, then supply a reading from the input to the PDU that support the IT equipment.
 - b. IT Energy will be entered in the attribute section of Portfolio Manager. However, the functionality will be similar to a typical energy meter, enabling users to enter monthly energy values.
4. Cooling Equipment Redundancy (optional)
 - a. Redundant components are typically required to accommodate the Data Center in the event of equipment failure. The specific level of redundancy will depend on the Data Center and its particular functions. Please select the redundancy level that best applies to the mechanical cooling equipment. If there are multiple systems operating at different levels of redundancy, choose the option that applies to the majority of the data center cooling load.
 - b. This question will have a dropdown menu with the following options:
 - i. N
 - ii. N+1
 - iii. N+2
 - iv. 2N
 - v. Greater than 2N
 - vi. None of the Above

5. UPS System Redundancy (optional)

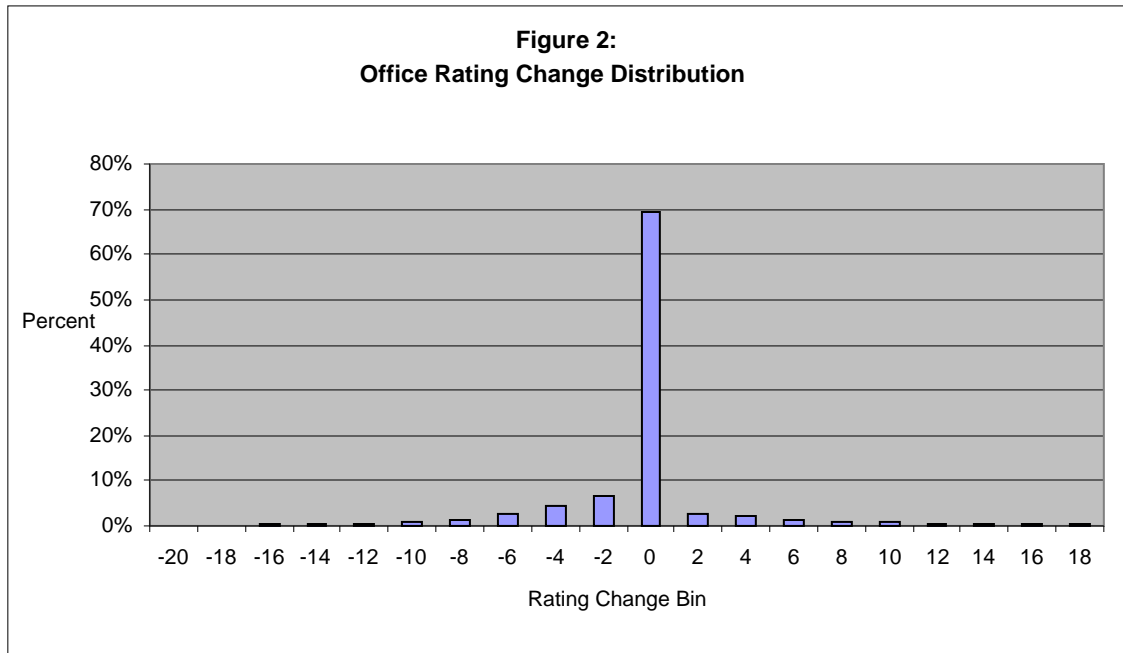
- a. Redundant components are typically required to accommodate IT loads in the event of equipment failure. The specific level of redundancy will depend on the Data Center and its particular functions. Please select the redundancy level that best applies to the Uninterruptible Power Supply (UPS) at the Data Center. If there is no UPS system, indicate the redundancy for the PDUs that support the IT load. If there are multiple systems operating at different levels of redundancy, choose the option that applies to the majority of the IT load.
- b. This question will have a dropdown menu with the following options:
 - i. N
 - ii. N+1
 - iii. N+2
 - iv. 2N
 - v. Greater than 2N
 - vi. None of the Above

II. Office Changes

Office Rating Changes

The initial report provided by SRA included 41,419 Office buildings. A basic set of filters was established by EPA to remove extreme/questionable data from the analysis. A complete list of filters is provided in **Attachment A**. After the filters, a total of 40,338 buildings were analyzed.

- The average change across all 40,338 offices is +1 point
 - 18% experience a decrease, with an average of -5 points
 - 14% experience an increase, with an average of +10 points
 - 68% experience no change
- **Figure 2** presents the distribution of rating changes for Offices. The distribution is close to normally distributed about zero, indicating that changes are neither large nor skewed in one direction. Over 80% of building change within +/-3 points.



Office Label Eligibility

At the time when the data was pulled (January 24, 2010), 3,466 of the offices in the analysis had earned the label.

- Recent winners – Out of the 2,811 that have earned a label in 2008 or 2009:
 - 2,690 buildings have ratings of 75 or higher prior to the change
 - 2,500 will continue to have ratings of 75 or higher after the release
 - 190 will have ratings that drop below 75, *these buildings will lose label eligibility*
 - 121 buildings actually have ratings below 75 prior to the change
 - 49 will see an increase with the release, bringing the rating to 75 or higher
 - 72 will continue to have ratings below 75 after the release
- General eligibility
 - With the new rating, 14,615 of the offices in the analysis have ratings of 75 or higher – *in other words, 36% of the Offices in Portfolio Manager are eligible for the ENERGY STAR.*
 - This compares to 14,433 eligible offices (36%) with the old rating.

Office Technical Details

The new Office model has been updated to limit adjustments for Square Feet and Personal Computer Density. Note that buildings with Office, may also have Data Center, Retail, or Open Parking and be affected by those changes, as well. Basic characteristics of the changes to the office calculation are as follows:

- **Square Foot cap:** Buildings with larger square foot values were formerly receiving large energy adjustments and higher ratings. Analysis of CBECS and Portfolio Manager has shown that it is necessary to bound the adjustment for square foot; this bound has been set at 200,000 square foot. Buildings over 200,000 square foot do not have higher EUIs than buildings that are 200,000 square foot, therefore they no longer receive an extra adjustment.
- **Personal Computer Cap:** Similarly, buildings with extremely high PC density were formerly receiving too generous of an adjustment for energy. Analysis of CBECS and Portfolio Manager has shown that it is necessary to bound the allowance for PC density; this bound has been placed at 11.1 PCs per 1,000 square foot.

As shown above, the average office building is not expected to experience a large change in rating. Correlations with rating changes are observed for the following characteristics:

- **Size:** Only Offices larger than 200,000 square foot will be affected by the new square foot calculation. These offices make up 19% of all of the office buildings in Portfolio Manager but they represent 53% of the buildings with rating changes, the majority of these buildings experience rating decreases, because their energy adjustment is now capped.
- **Data Center:** Office buildings with data centers represent approximately 19% of offices and are expected to have rating increases due to the new Data Center methodology. Their average change is approximately +7 points. The size of the increase is expected to be bigger for buildings with data centers that represent a larger percentage of building square foot.
- **Personal Computer Density:** Only Offices with PC density above 11.1 will be affected by the new personal computer calculation. The average PC Density is only 2.4; a value over 11.1 is most likely a data entry error. Only 212 offices (0.5%) have PC Density values in that range. This small group of buildings will see a decrease, with an average of -7.6 points. The average rating before the change is 68 points, with the average rating after the change being 61 points, demonstrating that the decrease in ratings does not result in any unfair bias for these facilities.
- **Offices with Parking:** The majority of offices smaller than 20,000 square feet with open floor space parking will experience a rating decrease due to the update to the parking adjustment. The average decrease for these buildings is -1. Due to the interaction of building characteristics and the other updates there is no major trend for larger buildings with parking because the parking energy contributes a smaller percentage of the overall energy use.

Office User Inputs

There are no changes to user input requirements.

III. Retail Changes

Retail Rating Changes

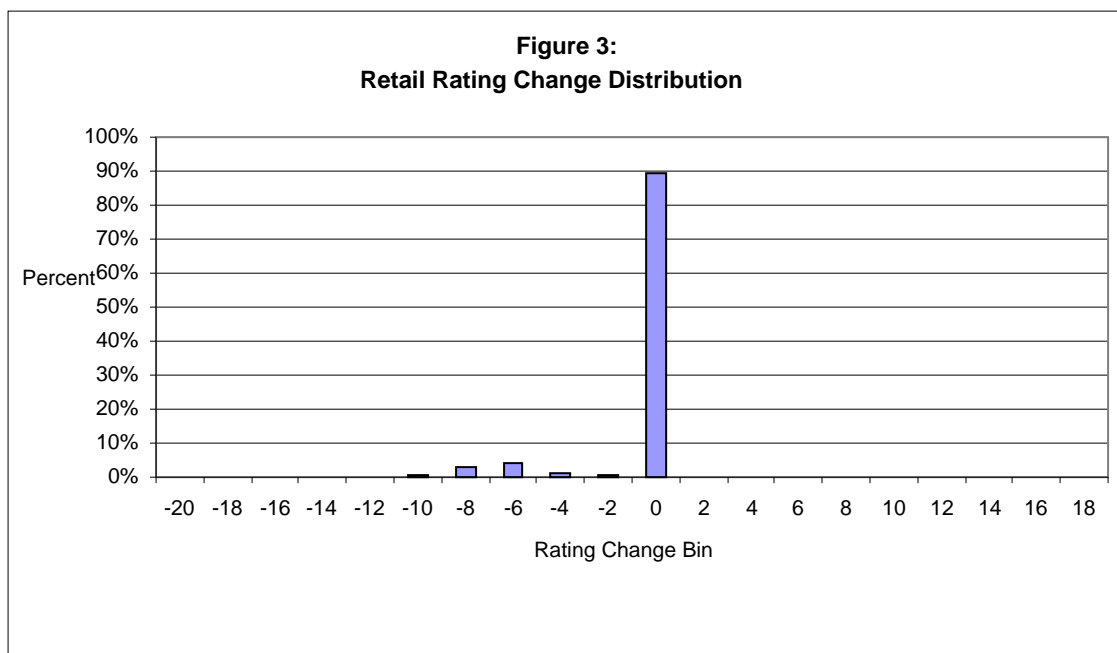
The initial report provided by SRA included 17,612 Retail buildings. A basic set of filters was established by EPA to remove extreme/questionable data from the analysis. A complete list of filters is provided in **Attachment A**. After the filters, a total of 16,610 Retail buildings were analyzed.

- The average change across all 16,610 retail buildings is -1 point.
 - 10% experience a decrease, with an average of -7 points
 - 0% (4 buildings) experience an increase, with an average of 2 points
 - 90% experience no change
- **Figure 3** presents the distribution of rating changes for Retail buildings. The distribution is close to normally distributed about zero with a slightly negative skew, indicating that changes are not large but are mostly negative. The majority of changes are within +/-3 points. Over 90% of the buildings change within +/- 3 points.

Retail Label Eligibility

At the time when the data was pulled (January 24, 2010), 509 of the retail buildings in the analysis had earned the label.

- Recent winners – Out of the 505 that have earned a label in 2008 or 2009:
 - 448 currently have and will continue to have ratings of 75 or higher
 - 31 currently have and will continue to have ratings below 75
 - 26 buildings currently have ratings above 75 which are expected to drop below 75 with the release, *these buildings will lose label eligibility*.
- General eligibility
 - With the new rating, 5,139 of the retail facilities in the analysis have ratings of 75 or higher – *in other words, 31% of the Retail buildings in Portfolio Manager are eligible for the ENERGY STAR.*
 - This compares to 5,501 eligible retail buildings (33%) with the old rating.



Retail Technical Details

The new Retail model has been updated with a cap on Register Density. Note that buildings with Retail may also have Office, Data Center, or Open Parking and be affected by those changes, as well. Basic characteristics are as follows:

- **Register Density cap:** Analysis of CBECS and Portfolio Manager has shown that buildings with very high values for register density were receiving too generous of an adjustment within Portfolio Manager. While buildings with higher densities do need an allowance, over a certain value the trend levels off and an additional adjustment is not necessary. Thus, similar to the bound for PC Density in Offices, the retail calculation for register density has been bounded at 0.71 registers per 1,000 square foot. This value is well above the average value, representing the 98th percentile within CBECS. Thus, it is a small number of retail stores.

Overall, the average Retail rating decreased by approximately -1 point. The rating change for each building depends on the interaction of all of the updates. Correlations with rating changes are observed for the following operating characteristics:

- **Register Density:** Only buildings with register density above 0.71 are affected by the calculation change. The average Register Density is only 0.3; a value over 0.71 is most likely a data entry error or data referencing hand held point of sale devices, and not true registers. A total of 188 buildings (or, 1%) have register density above 0.71; their average change is -18 points. Prior to the release, the average rating is approximately 87 points, hence the 18 point decrease is appropriate for these facilities, bringing the new average rating to 69, which is still above average.
- **Parking:** Only 1,590 retail buildings have open parking areas (about 10% of the retail sample). These buildings are more likely to experience a decrease due to the correction in the Open Parking calculation. The larger the parking lot is relative to the size of the building, the greater the decrease in rating.
 - The average rating change for all retail buildings with parking was -6.
 - For parking areas that are either less than 200,000 square foot or less than 60% of the building floor area, the average change is only -3.

Retail User Inputs

There are no changes to user input requirements.

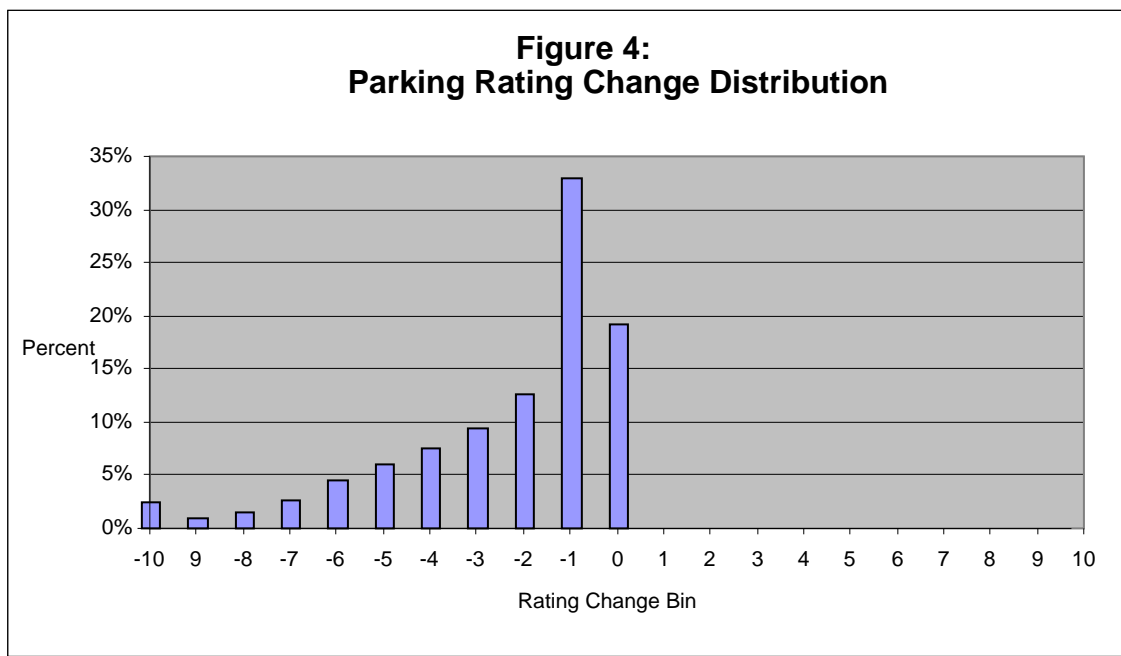
IV. Parking Changes

Parking Rating Changes

The initial report provided by SRA included 16,781 buildings with Parking. A basic set of filters was established to remove extreme data from the analysis. A complete list of filters is provided in **Attachment A**. After the filters, a total of 13,580 buildings were analyzed.

- The average change across all 13,580 buildings with parking is -3 points

- 81% experience a decrease, with an average of -4 points
- 19% experience no change
- **Figure 4** presents the ratings changes for buildings with Parking. The distribution is one sided with a maximum at zero and centered around -1, indicating that most facilities with parking experience a small rating decrease. The majority of changes are within +/-2 points.
 - Over 37% of buildings change within +/- 1 point
 - Over 52% of buildings change within +/- 2 points
 - Over 97% of buildings change within +/- 10 points
- The 13,580 buildings with Parking represent different building types. **Table 3** below shows the average rating change for each building type.



Building Type	Count	Average Rating Change
Office	6523	-2
K-12 School	3416	-4
Retail	1621	-6
Hospital (Acute Care or Children's)	678	-1
Hotel	592	-1
Bank/Financial Institution	220	-4
Medical Office	203	-3
Warehouse (Unrefrigerated)	122	-4
Courthouse	106	-3
Supermarket/Grocery	40	NA
Residence Hall/Dormitory	38	NA
House of Worship	13	NA

Warehouse (Refrigerated)	8	NA
<i>Averages not shown for types with fewer than 50 buildings</i>		

Parking Label Eligibility

Label Eligibility information is not specifically available for Parking because Parking is not a primary building type and because the parking correction was added to the release after the initial data pull.

Parking Technical Details

The change in the parking lot calculation is a correction to a defect in the tool. The coefficient for the lighting allowance at an open parking lot was incorrect (too high). This has been corrected. Because the new coefficient is smaller, buildings with Open Parking are expected to see a decrease in rating, as was shown above. There are *no changes* to the calculations for enclosed or partially enclosed parking structures. The change only affects open parking lot.

There are a few trends with respect to building characteristics

- **Relative Size of Open Parking** – The effect of lowering the adjustment for parking will be more evident in buildings with parking areas that are larger, especially in comparison to the main building. While the average decrease is -3 points overall, it is only -2 points for those buildings where Open Parking square footage is less than 60% of the size of the building.
- **Building Type** – Certain building types are more likely to have smaller buildings with larger open parking lots. Because the open parking is comparatively large for these buildings, they are more likely to see a rating decrease. These building types are: Retail, School, Bank, Worship, and Warehouse. As shown in Table 3, they have bigger average decreases because of this typical building configuration.

Parking User Inputs

There are no changes to user input requirements.

Attachment A –Filters for Analysis

Data Center Filters for Analysis		
Condition for Including a Record in the Analysis	Records Removed	Records Remaining
Building includes Data Center	--	13,869
Building received a rating	2,385	11,484
Source EUI >= 10	125	11,359
Source EUI <= 3,000	43	11,316
All Initial Filters	168	11,316

Office Filters for Analysis		
Condition for Including a Record in the Analysis	Records Removed	Records Remaining
Building Type = Office, Bank/Financial Institution, Courthouse	--	41,419
EUI > 10	410	41,009
EUI < 3000	330	40,679
Worker Density < 50	306	40,373
Walk-in Density < 0.2	23	40,350
Building Received a Rating	12	40,338
All Initial Filters	1,081	40,338

Retail Filters for Analysis		
Condition for Including a Record in the Analysis	Records Removed	Records Remaining
Building includes Retail space	--	17,612
Building Type = Retail	647	16,965
Number of Primary Spaces = 1	156	16,809
Building Receives a Rating	0	16,809
EUI > 10	76	16,733
EUI < 3000	25	16,708
Worker Density > 0.2	98	16,610
Worker Density < 50	0	16,610
PC Density <50	0	16,610
All Initial Filters	1,002	16,610

Parking Filters for Analysis		
Condition for Including a Record in the Analysis	Records Removed	Records Remaining
Building includes Parking	--	16,781
Building Receives a Rating	3,053	13,728
EUI > 10	100	13,628
EUI < 3000	48	13,580
All Initial Filters	3,201	13,580